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ABSTRACT

This instructional package contains two biological units developed for the Dade County Florida Quinmester Program. "Introduction to Life Sciences" develops student understandings of cell structure and function, and compares different levels of cellular organization. "Cell Biology" investigates the origin of modern cellular theories and controversies, and the molecular approach to cell reproduction and metabolism. Each booklet includes performance objectives for the unit, lists state-adopted texts, provides a synoptic summary of the course content, suggests activities and projects, indicates audio-visual materials available in the county and from other sources, and recommends reference books. Each booklet contains a chart relating each suggested activity to specific performance objectives. (CP)

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ED 063122

# AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

Science: CELL BIOLOGY 5314.14

DADE COUNTY PUBLIC SCHOOLS

DIVISION OF INSTRUCTION • 1971

# CELL BIOLOGY
# 5314.14
# SCIENCE
# (Experimental)

Written By Barbara A. Silver and Charlotte Miller
for the
DIVISION OF INSTRUCTION
Dade County Public Schools
Miami, Fla.
1971

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Miami, Florida 33132

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# CELL BIOLOGY

## COURSE DESCRIPTION

This course is designed to introduce the student to the origin and evolution of living cells. Beginning with a consideration of various explanations of how life originated on earth, organic evolution is presented as a unifying concept. Emphasis is given to modern explanations of chemical and biological evolution including energy processes in cells and the molecular control of nucleic acids. The preceding topics lead to a consideration of the cell as a biological unit with both structure and function.

## ENROLLMENT GUIDELINES

This course is strongly suggested for college bound students and those who desire one credit in biology. There are no pre- or corequisites.

## STATE ADOPTED TEXTS

1. Biological Sciences Curriculum Study Committee. Biological Science: An Inquiry Into Life, (Yellow Version), 2nd. ed. New York: Harcourt Brace and World, 1968.

2. Biological Sciences Curriculum Study Committee. Biological Science: Molecules to Man, (Blue Version), 2nd. ed. Boston: Houghton-Mifflin Company, 1968.

3. Biological Sciences Curriculum Study Committee. High School Biology: BSCS Green Version, 2nd. ed. Chicago: Rand McNally & Co., 1968.

*4. Otto, James H. and Towle, Albert. Modern Biology. New York: Holt, Rinehart and Winston, Inc., 1965.

5. Smallwood, William L. and Green, Edna R. Biology. Morristown, New Jersey: Silver Burdett Co., 1971.

*6. Weinberg, Stanley L. Biology: An Inquiry Into the Nature of Life. Boston: Allyn and Bacon, Inc., 1965.

* Off the adopted list, June, 1971.

## PERFORMANCE OBJECTIVES

The student will:

1. Differentiate between abiogenesis and biogenesis.
2. Evaluate the experiments of the following scientists as they pertain to the spontaneous generation controversy:
   a. Van Helmont
   b. Redi
   c. Needham
   d. Spallanzani
   e. Pasteur
3. Identify three alternative hypotheses for the origin of life.
4. Apply the experiments of Miller and Fox to the meaning of the heterotroph hypothesis.
5. Differentiate among the sources of energy available to living organisms in terms of the usability of each.
6. List several uses of energy in living organisms.
7. Describe the role of enzymes in living cells.
8. Relate the chemical structure of ATP to its biological function.
9. Compare the processes of fermentation and aerobic respiration in terms of
   a. raw materials
   b. end products
   c. energy yield
10. Apply the structure of DNA to its function in living cells.
11. Investigate the following procedures as they pertain to the discovery of the structure and function of DNA:
   a. bacterial transformation (pneumococcus)
   b. bacterial transduction ($T_2$ bacteriophage)
   c. X-ray diffraction of DNA
   d. chemical analysis of DNA
12. Relate the structure of DNA to its coding capabilities.
13. Describe the research which led to the cracking of the DNA code.
14. Relate the roles of DNA and RNA in protein synthesis.
15. Describe the process of protein synthesis.
16. Recognize the importance of proteins in the makeup and activities of cells.
17. Analyse the experiments of Beadle and Tatum as they relate to the role of genes.
18. Relate the structures of a cell to their functions.
19. Explain the processes by which materials may enter and leave a cell.
20. Identify the contributions made by each of the following scientists to our present knowledge of the cell:
   a. Robert Hooke
   b. Robert Brown
   c. Theodore Schwann and Matthias Schleiden
   d. Rudolf Virchow

## COURSE OUTLINE

I. ORGANIC EVOLUTION

A. Origin of Living Things
   1. The meaning of abiogenesis and biogenesis
   2. The spontaneous generation controversy
      a. Joan Baptiste Van Helmont
      b. Francisco Redi
      c. John Needham
      d. Lazzaro Spallanzani
      e. Louis Pasteur

B. Alternative hypotheses for the origin of life
   1. Life from outer space
   2. The autotroph hypothesis
   3. The heterotroph hypothesis

C. Forerunners of life
   1. The age of the earth
   2. Descriptions of the ancient earth
   3. Experimental evidence to support the heterotroph hypothesis
      a. Dr. Stanley Miller (1953)
      b. Dr. Sidney Fox (1957)
   4. Chemical foundations for biology

II. CHEMICAL ENERGY FOR LIFE

A. Needs and sources of energy
   1. Potential energy vs. kinetic energy
   2. The uses of chemical bond energy in living cells

B. The nature of enzymes and their role in living cells

C. The role of ATP in living cells

D. Energy releasing processes in living cells
   1. Fermentation
   2. Respiration

III. MASTER MOLECULES

A. The structure and function of nucleic acids
   1. The composition of DNA and RNA
   2. The role of nucleic acids in cells
   3. The Watson-Crick Model of DNA

B. Biological Code
   1. Research in cracking the code
   2. The code at work: protein synthesis

C. Gene Theory
   1. The nature of genes
   2. The mutability of genes

IV. THE EVOLVED CELL

A. Cell structure and function
   1. Nucleus
   2. Cytoplasm

B. Cell transport
   1. Diffusion and osmosis
   2. Active transport

C. Development of the Cell Theory
   1. Technological developments - microscopy
   2. The contributions of scientists
   3. The meaning of the "Cell Theory"

EXPERIMENTS

Biological Sciences Curriculum Study. Biological Science: An Inquiry Into Life - Student Laboratory Guide. Yellow Version, 2nd. ed., New York: Harcourt, Brace & World, Inc., 1968.

1. Life from Nonlife? (Ex. 2-1, p. 22)
2. Acids, Bases, and Cells (Ex. 6-1, p. 40)
3. A Chemical Reaction of Living Cells (Ex. 4-1, p. 29)
4. An Enzyme in Plant and Animal Tissues (Ex. 5-1, p. 32)
5. Oxidation-Reduction in Living Cells (Ex. 5-4, p. 38)
6. An Analysis of DNA (Ex. 8-1, p. 55)
7. Cork - An Investigation into Form and Function (Ex. 3-1, p. 23)
8. Cells of Living Plants (Ex. 3-2, p. 25)
9. Cells from You and Frogs (Ex. 3-3, p. 28)
10. The Closed Box Mystery (Ex. 3-3, p. 28)
11. Reactions of Cells in Changing Environments (Ex. 6-5, p. 51)

Biological Sciences Curriculum Study. Biological Science: Molecules to Man. (Blue Version) 2nd. ed. Boston: Houghton-Mifflin Co., 1968.

12. Investigating Sources of Bacterial Growth (Ex. 4-6, p. 94)
13. Investigating the Properties of Acids and Bases (Ex. 5-9, p. 120)
14. Investigating the Formation of Coacervates (Ex. 5-14, p. 132)
15. Investigating the Work of Simple Catalysts (Ex. 6-4, p. 143)
16. Investigating Fermentation (Ex. 6-8, p. 150)
17. Investigating the Effect of Oxygen on Cell Growth (Ex. 8-3, p. 198)
18. Investigating Chemical Breakdown of Sugar (Ex. 8-6, p. 203)
19. Investigating Pneumococcus and DNA (Ex. 9-3, p. 219)
20. Investigating Effects of Mutants in Bacteria (Ex. 10-9, p. 244)
21. Investigating Mutants in Neurospora (Ex. 10-12, p. 249)
22. Investigating Relationship between Diffusion and Cell Size (Ex. 11-2, p. 265)
23. Investigating Cell Membrane Activity (Ex. 6-12, p. 155)
24. Investigating the Compound Microscope (Ex. 1-13, p. 21)

Biological Sciences Curriculum Study. High School Biology: BSCS Green Version, 2nd. ed. Chicago: Rand McNally & Co., 1968.

25. Experiments on Spontaneous Generation (Ex. 6.4, p. 209)
26. Bioenergetics: An Introductory View (Ex. 12.1, p. 408)
27. A Study of Biochemical Reactions (Ex. 12.2, p. 411)
28. Fermentation (Ex. 12.3, p. 420)
29. Diversity in Cell Structure (Ex. 11.1, p. 385)
30. Diffusion through a Membrane (Ex. 11.2, p. 388)
31. Use of the Microscope: Introduction (Ex. 1.3, p. 11)
32. Use of the Microscope: Biological Material (Ex. 1.4, p. 16)

Otto, James M., Towle, Albert and Crider, Elizabeth M. Biology Investigations. New York: Holt, Rinehart and Winston, Inc., 1965.

33. Growth Characteristics of Living Organisms (Ex. 2-1, p. 21)
34. Solutions, Colloids, and Suspensions (Ex. 3-1, p. 25)
35. Cellular Respiration (Ex. 7-1, p. 59)
36. Study of Cells (Ex. 4-1, p. 33)
37. Variation in Cell Structure (Ex. 4-2, p. 35)
38. Principles of Diffusion (Ex. 5-1, p. 37)
39. Diffusion and Osmosis (Ex. 5-2, p. 39)
40. Diffusion through Cell Membranes (Ex. 5-3, p. 43)

DEMONSTRATIONS

Abramoff, Peter and Thomson, Robert C. Investigation of Cells and Organisms. Englewood Cliffs: Prentice - Hall, Inc., 1968.

1. An Artificial Cell (Ex. 11, p. 32)

Biological Sciences Curriculum Study. Biological Science: Molecules to Man. (Blue Version) 2nd. ed., Boston: Houghton Mifflin Co., 1968.

2. Investigating the Composition of Water (Ex. 5-4, p. 114)
3. Investigating the Effect of Radiation on Microorganisms (Ex. S-7, p. 761)

PROJECTS

1. Prepare bulletin board demonstrations comparing the experiments performed by Van Helmont, Redi, Needham, Spallanzani, and Pasteur in the spontaneous generation controversy.

2. Construct molecular models of such biologically important substances as ATP, glucose, DNA and RNA.

3. Construct models of "typical" plant and animal cells.

4. Prepare a poster showing the relationship between cell structures and their functions.

5. Attempt to maintain cultures of pond water organisms and/or pure cultures of microorganisms.

6. Keep a "current science" notebook containing clippings about any of the topics in this course.

REPORTS

1. Do biographical reports on such scientists as:
   a. Jean Baptiste Van Helmont
   b. Francesco Redi
   c. John Needham
   d. Lazzaro Spallanzani
   e. Louis Pasteur
   f. A. T. Oparin
   g. John B. Haldane

2. Read and report on The Double Helix by James D. Watson, the personal account of the discovery and development of the model of DNA.

3. Do research reports on the work done in the field of the genetic code and such men as Svero Ochoa, Joshua Lederberg, George Beadle, Edward L. Tatum and Marshall Nirenberg.

4. Do reports on various cellular organelles describing their gross structure, molecular composition and function.

5. Do research on the development of the compound microscope, the phase microscope, the electron microscope, or methods of preparing specimens for microstudy.

6. Do biographical reports on such scientists as:
   a. Robert Hooke
   b. Robert Brown
   c. Theodore Schwann
   d. Matthias Schleiden
   e. Rudolf Virchow
   f. Walter Flemming

RELATED PROBLEMS

1. The origin of the earth.
2. Techniques of dating the earth.
3. Atomic theory.
4. Chemical bonding.
5. Catalysis.
6. The role of scientific models.
7. The relationship between cell size and cell function.
8. The relationship of a single cell of a multicellular organism to the entire organism.

FILMS AVAILABLE FROM DADE COUNTY AUDIOVISUAL SERVICES

1. Life on Other Planets
   AV# 1-30617, 28', BW & C
2. Origin of Life
   AV# 1-30612, 28', C
3. Prehistoric Times: The World before Man
   AV# 1-01992, 10', C
4. World Is Born, A
   AV# 1-10631, 20', C
5. Cell's Chemical Organization, A
   AV# 1-30505, 30', C
6. Catalysis
   AV# 1-10809, 16', C
7. Cell Respiration
   AV# 1-30499, 30', C
8. DNA: Molecule of Heredity
   AV# 1-11078, 16', C
9. Cell Biology: Regulation and Control
   AV# 1-30516, 30', C
10. Biochemical Genetics
    AV# 1-30572, 28' C
11. Cell Biology: Life Functions
    AV# 1-13772
12. Cell Biology: Structure and Composition
    AV# 1-13812
13. From Atoms to Organisms
    AV# 1-30399, 28', C
14. Cell: Structual Unit of Life
    AV# 1-02231, 10', BW
15. Cell Biology: What Is a Cell?
    AV# 1-30526, 30', C
16. Cell Biology: The Unit of Life
    AV# 1-30525, 30', C
17. Cell Biology: Responsiveness
    AV# 1-30504, 30', C
18. Cell Biology: Growth and Replacement
    AV# 1-30510, 30', C

19. Cell Biology: Transfer of Materials
AV# 1-30520, 30', C
20. Osmosis
AV# 1-11237, 22', BW
21. Osmosis
AV# 1-11094, 14', C
22. The Microscope
AV# 1-02240, 11', C
23. Fixing and Cutting Sections
AV# 1-11084, 12', C
24. Staining
AV# 1-02247, 10', C

## SUGGESTED DISCUSSION QUESTIONS

1. How does the heterotroph hypothesis differ from the abiogenesis view of spontaneous generation?
2. How is energy transformed and utilized by living cells?
3. How is cellular activity regulated on the molecular level?
4. How does the composition and structure of deoxyribonucleic acid (DNA) lend itself to being the molecular code of life?
5. How does the type of protein produced by a cell determine the overall physical and functional nature of a cell?
6. How is the complementarity of structure and function demonstrated by living cells?
7. What forces affect the transfer of materials into, out of, and through a cell?
8. How has technological development affected advances in our knowledge of DNA, RNA, cell structure and cell function?
9. How does the cell theory relate to the heterotroph hypothesis?

## ADDITIONAL INNOVATIVE ACTIVITIES

1. Use LIFE reprint article "Scientists Close In On The Secret of Life" as either an introduction to DNA or as a summation.
2. Use a variety of prepared slides to illustrate how unicellular organisms demonstrate the basic characteristics of cells.
3. Use microslide viewers and booklets dealing with cell structure and variety. (Materials available from National Teaching Aids, Inc., 120 Fulton Ave., Garden City Park, New York 11040)
4. Describe career opportunities in fields related to cell biology.

REFERENCES


1. Asimov, Isaac. The Chemicals of Life. New York: New American Library, 1954. *

2. Asimov, Isaac. The Genetic Code. New York: New American Library, 1962. *

3. Asimov, Isaac. Life and Energy. New York: Bantam Books, Inc., 1962. *

4. Barish, Natalie. The Gene Concept. New York: Reinhold Publishing Corporation, 1965. *

5. Biological Sciences Curriculum Study Committee. Biological Science: An Inquiry Into Life, (Yellow Version) 2nd. ed. Harcourt, Brace and World, 1968.

6. Biological Sciences Curriculum Study Committee. Student Laboratory Guide - Biological Science: An Inquiry Into Life, (Yellow Version) 2nd. ed. New York: Harcourt, Brace and World, 1968.

7. Biolgical Sciences Curriculum Study Committee. Teacher's Manual - Biological Science: An Inquiry Into Life. New York: Harcourt, Brace and World, Inc., 1968.

8. Biological Sciences Curriculum Study Committee. Biological Science: Molecules to Man, (Blue Version) 2nd. ed. Boston: Houghton-Mifflin Co., 1968.

9. Biological Sciences Curriculum Study Committee. Molecules to Man - Answer Key and Teacher's Guide to Laboratory Investigations, 2nd. ed. Boston: Houghton-Mifflin Co., 1968.

10. Biological Sciences Curriculum Study Committee. High School Biology: BSCS Green Version, 2nd. ed. Chicago: Rand McNally & Co., 1968.

11. Biological Sciences Curriculum Study Committee. Teacher's Guide to High School Biology. 2nd. ed. Chicago: Rand McNally & Co., 1968.

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14. Giese, Arthur C. Cell Physiology. Philadelphia: W. B. Saunders Company, 1962.

15. Hoffman, Katherine. Chemistry of Life. Washington, D. C.: National Science Teachers' Association, 1964. *

16. Keosian, John. The Origin of Life. New York: Reinhold Publishing Corporation, 1964. *

17. Klinckmann, Evelyn. Biology Teacher's Handbook. 2nd. ed., New York: John Wiley and Sons, Inc., 1970.

18. Locke, David M. Enzymes - The Agents of Life. New York: Crown Publishers, Inc., 1969.

19. Loewy, Ariel G. and Siekevitz, Philip. Cell Structure and Function. New York: Holt, Rinehart and Winston, 1963. *

20. McElroy, William D. Cell Physiology and Biochemistry. 2nd. ed. Englewood Cliffs: Prentice-Hall, Inc., 1964. *

21. Morrison, John H. Functional Organelles. New York: Reinhold Publishing Corporation, 1966. *

22. Oparin, A. I. The Origin of Life. New York: Dover Publications, Inc., 1953. *

23. Otto, James H., Towle, Albert and Crider, Elizabeth H. Biology Investigations. New York: Holt, Rinehart and Winston, Inc., 1965.

24. Otto, James H. and Towle, Albert. Modern Biology. New York: Holt, Rinehart and Winston, Inc., 1965.

25. Swanson, Carl. The Cell. 2nd. ed. Englewood Cliffs: Prentice-Hall, Inc., 1964. *

26. Watson, James D. The Double Helix. New York: New American Library, 1968. *

27. Weinberg, Stanley L. Biology An Inquiry Into the Nature of Life. Boston: Allyn and Bacon, Inc., 1966.

28. Weisz, Paul B. The Science of Biology. 3rd. ed. New York: McGraw-Hill Book Company, 1967.

29. White, Emil H. Chemical Background for the Biological Sciences. Englewood Cliffs: Prentice-Hall, Inc., 1964. *

*Available in paperback.

MASTER SHEET - CELL BIOLOGY

| Objectives | Laboratory Investigations | Student Text References | Supplementary References | Films | Demonstrations | Discussions | Additional Activities |
|---|---|---|---|---|---|---|---|
| 1 and 2 | 1, 12, 25, 33 | 1-Ch.2;2-Ch.4; 3-Ch.2,5; 4-Ch.1;6-Ch.24 | 12, 16, 22, 28 | 1, 2 | 1 | 1 | Project 1 Report 1 |
| 3 | | 1-Ch.39;2-Ch.4; 6-Ch.24 | 12, 16, 22, 28 | 1, 2 | | 1 | |
| 4 | 2, 13, 14, 34 | 1-Ch.39;2-Ch.5; 3-Ch.10;6-Ch.24; | 12, 16, 22, 28 | 1, 2, 3, 4 | 2 | | |
| 5 and 6 | 26 | 1-Ch.5-6; 2-Ch.6;3-Ch.12; 4-Ch.3,6; 6-Ch.4 | 1, 3, 15, 28 | | | 2 | |
| 7 | 3, 4, 15, 27 | 1-Ch.6;2-Ch.6; 3-Ch.12; 4-Ch.3;6-Ch.4 | 1, 3, 14, 15, 18, 20, 28, 29 | 5, 6 | | 2 | |
| 8 and 9 | 5, 16, 17, 18, 28, 35 | 1-Ch.6,11; 2-Ch.6,8; 3-Ch.12; 4-Ch.6,7;6-Ch.4 | 1, 3, 14, 15, 17, 20, 28, 29 | 7 | | 2 | Project 2 |
| 10 and 11 | 6, 19 | 1-Ch.8;2-Ch.9; 3-Ch.17; 4-Ch.3, 7; 6-Ch.21 | 1, 2, 4, 15, 17, 20, 28, 29 | 8, 9, 10 | | 3, 4 | Project 2 Report 2 |
| 12 13 14 15 16 17 | 20, 21 | 1-Ch.8;2-Ch.10; 3-Ch.17; 4-Ch.7,10; 6-Ch.21 | 1, 2, 4, 15, 17, 20, 26, 28, 29 | 8, 9, 10 | 3 | 4, 5, 8 | Report 3 1 |
| 18 | 7, 8, 9, 29, 36, 37 | 1-Ch.3,6; 2-Ch.11;3-Ch.11 4-Ch.5;6-Ch.2 | 13, 14, 19, 20, 21, 25, 28 | 11, 12, 13, 14, 15, 16, 17, 18 | 1 | 6 | Projects 3, 4, 5 Report 4 2, 3 |
| 19 | 10, 11, 22, 23, 30, 32, 38, 39, 40 | 1-Ch.6;2-Ch.6; 3-Ch.11; 4-Ch.5;6-Ch.2 | 13, 14, 19, 20, 21, 25, 28 | 19, 20, 21 | | 7 | |
| 20 | 7, 24, 31, 32 | 1-Ch.3;2-Ch.11; 3-Ch.11;4-Ch.4; 6-Ch.2 | 25, 28 | 14, 15, 16 | | 8, 9 | Reports 5,6 |

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AUTHORIZED COURSE OF INSTRUCTION FOR THE QUINMESTER PROGRAM

# INTRODUCTION TO LIFE SCIENCE

5311.10
5312.10
5313.10

SCIENCE

(Experimental)

DADE COUNTY PUBLIC SCHOOLS

DIVISION OF INSTRUCTION • 1971

# INTRODUCTION TO LIFE SCIENCE

5311.10

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SCIENCE

(Experimental)

Written by Charlotte Miller and June Castaldi

for the

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DADE COUNTY SCHOOL BOARD

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# INTRODUCTION TO LIFE SCIENCE

## COURSE DESCRIPTION:

A basic course in beginning biology with emphasis on the characteristics of all living things and their interrelationships, including relationship to their environment.

## ENROLLMENT GUIDELINES

None.

## STATE ADOPTED TEXTS

*1. Brandwein, Beck, Strahler, Hollingworth, and Brennan. The World of Living Things. New York: Harcourt, Brace and World, Inc., 1964.

2. Brandwein, Stollberg, Burnett. Life, Its Forms and Changes. New York: Harcourt, Brace, and World, Inc., 1968.

3. Oxenhorn and Idelson, Pathways in Science (Biology 1) New York: Globe Book Co., 1968.

4. Thurber and Kilburn, Exploring Life Science, Boston: Allyn and Bacon, Inc., 1966.

* Off the adopted list

**PERFORMANCE OBJECTIVES**

1. The student will describe a given number of characteristics of living things.

2. Given a diagram of a typical cell, the student will label important structures.

3. Given certain cell structures, the student will identify the functions.

4. The student will compare the process of osmosis and diffusion.

5. The student will investigate the process of cell division.

6. The student will differentiate between plant and animal cells.

7. From a selected group of cells, the student will describe the function of at least one.

8. Given selected examples of tissues, organs, and organ systems, the student will distinguish smong them.

9. The student will distinguish between single-celled and multi-cellular organisms.

10. The student will suggest reasons for the increasing complexity of organisms.

11. Given groups of living things, the student will compare the differences among them.

12. The student will integrate the various factors that contribute to interdependence.

COURSE OUTLINE

I. Characteristics of Living Things

A. Nutrition

B. Respiration

C. Excretion

D. Secretion
1. Enzymes
2. Hormones

E. Movement

F. Sensitivity

G. Reproduction

II. Structure and Function of a Typical Cell

A. The Nucleus
1. Structure
2. Cell reproduction

B. The Cytoplasm
1. Composition
2. Structures within cytoplasm

C. Cell Membrane
1. Structure
2. Cell transportation

III. Similarities and Differences of Typical Plant and Animal Cells

IV. Specialization of Cells

A. Plant cells
1. Epidermal
2. Palisade
3. Xylem
4. Phloem

B. Animal cells
    1. Fat
    2. Bone
    3. Muscle
    4. Nerve
    5. Blood
    6. Epithelial

V. Tissues, Organs, Organ Systems

VI. Kingdoms of Living Things

    A. Protist

    B. Plant

    C. Animal

VII. Interdependence

    A. Adaptations to different habitats
        1. Aquatic
        2. Terrestrial

    B. Environmental factors
        1. Competition
        2. Predation
        3. Cooperation

    C. Food chains and communities
        1. Fresh water
        2. Marine
        3. Terrestrial
        4. Balance of nature

## EXPERIMENTS

Beauchamp, Mayfield, and Hurd. Science is Explaining. Chicago: Scott, Foresman and Co., 1963.

1. Does a plant give out carbon dioxide? (p. 150)
2. What are some of the important parts of cells? (p. 161)
3. What are the parts of the flower? (p. 168)
4. What do root hairs look like? (p. 212)
5. Where are the water-carrying tubes of plants? (p. 213)
6. Is light needed to make starch in a green leaf? (p. 215)

Brandwein, Beck, Strahler, Hollingworth, and Brennan. The World of Living Things. New York: Harcourt, Brace, and World, Inc., 1964.

7. Inside a living thing (p. 18).
8. Studyong check cells under a misroscope (p. 19)
9. Examining Elodea under the microscope (p 51)
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30. Investigating for plant parasites (p. 220)
31. Investigating the effect of soil fertilizers on the growth of plants (p. 232)

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32. Effects of salt water on fresh-water life (p. 25)
33. Paramecium's response to danger (p. 81)
34. Structure of a muscle cell (p. 87)
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36. Xylem tissue (p. 140)
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49. Practice in making observation and interpretation. (cells) (pp. 33-34)

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50. Observe cells (p. 38)
51. Study penicillium (p. 43)
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59. Life cycles of insects (pp. 239-240)

60. Stain and observe plant cells (p. 339)
61. View bacteria (p. 367)

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62. Observe cells (p. 348)
63. Examine a plant (p. 358)
64. How some animals react to stimuli (p. 364)

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65. How can the growth of micro-organisms in jello be prevented by a high concentration of sugar? (pp. 44-45)
66. How can materials move through a membrane? (p. 71)
67. Observe blood and blood clotting. (p. 78)
68. How do periods of light and darkness affect the growth of plants (p. 187)
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71. Examine a plant cell. (p. 209)
72. Observe chloroplasts (p. 210)
73. Examine stagnant water (p. 211)
74. How does the growth of leaves affect the plant (p. 220)

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75. How the chemical environment affects animals (p. 169)
76. Focus a microscope (p. 322)
77. How animal cells resemble and differ from plant cells. (p.326)

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78. Growing plants from seeds (p. 23)
79. Trapping and growing mold spores (p. 25)
80. How do seeds respond to water? (p. 49)
81. The cell membrane for entrance and exit (pp. 97-98

82. Can dissolved sodium chloride pass through the cell membrane? (p. 101)
83. Tissues for support (p. 103)
84. Photosynthesis and light (pp. 126-127)

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85. Experimental research on communities (pp. 43-45)
86. Mystery of the unexpected bodies (micro-organisms) (p. 114)
87. Micro-organisms in ponds (p. 120)
88. Yeast - a non-green plant (p. 126)
89. Molds (p. 132)
90. Experimental Research on micro-organisms (pp. 138-141)
91. Asexual reproduction (p. 242)
92. From seed to seedling (p. 338)
93. Plant cells (p. 370)
94. A model cell (p. 374)

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95. Field research on communities of living things. (p. 16)
96. Experimental research (communities )(p. 43-44)
97. Experimental research on insects (pp. 107-109)
98. Experimental research on effects of changes in the environment (pp. 139-141)
99. Experimental research on various micro-organisms (pp. 170-174)
100. Plant cells (pp. 402-405)
101. A model cell (p. 406)
100. Osmosis and diffusion (pp. 406-407)
101. Preparing leaf sections (pp. 414-417)

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102. Use of the microscope (p. 20)
103. Classification (p. 34)
104.. Classification of plants (p. 36)
105. Kinds of cells, Part I (p. 43)
106. Kinds of cells, Part II 9 P. 45)
107. Algae and fungi (p. 46)
108. Fungi (p. 48)

109. Bacteria cultures (p. 49)
110. Bacteria (p. 50)
111. Plant structures (p. 53)
112. Osmosis (p. 54)

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113. Microscope work (p. 54)
114. Germinating seeds (p. 114)
115. Root study (p. 59)

## DEMONSTRATIONS

Beauchamp, Mayfield, and Hurd, Science Is Explaining. Chicago: Scott, Foresman, and Co. 1963.

1. How does a plant respond to the stimulus of light (p. 151)

Brandwein, Beck, Strahler, Hollingsworth, and Brennan. The World of Living Things. New York: Harcourt, Brace and World, 1964.

2. Setting up an aquarium (pp. 107-108)
3. Setting up a terrarium (p. 211)

Brandwein, Stollberg, and Burnett. Life, Its Forms and Changes. New York: Harcourt, Brace and World, 1968.

4. Simple diffusion (p. 187)
5. Setting up a micropond (p. 531)
6. Making an aquarium (p. 532)
7. Making a woodland terrarium (p. 534)
8. Making a desert terrarium (p. 535)
9. Reactions of different plants to light (p. 34-35)
10. Variation of light intensity with latitude (p. 43)

Mason and Peters, Life Science, A Modern Course. Princeton: A. VanNostrand Co., 1965.

11. How do raw materials enter and leave the cell? (p. 53)

MacCracken, Decker, Gammons, Yarian, and Creswell. Scientists Explore. Syracuse: L.W. Singer Co., Inc., 1966.

12. How do scientists study the structure of nucleic acids? (p. 330)

**PROJECTS**

1. Make large detailed drawing of a plant and/or animal cell.
2. Build a model of a plant and/or animal cell out of clay.
3. Collect and classify plants. Mount them on a display board.
4. Collect and classify insects. Mount them on a display board.
5. Students set up a marine or fresh water aquarium.
6. Students set of a terrarium.
7. Culture protists or other microscopic organisms to be studied by the class.
8. Watch the growth of non vascular plants by collecting spores from mosses, lichens, mushrooms and planting them.
9. Make a picture exhibit depicting different kinds of communities.
10. Make a survey of life in a polluted stream, canal or lake and a non-polluted one.
11. Dig up an ant hill and make an ant farm that can be observed in class.

12. Find out how many different kinds of plants and animals live or are found in a yard, field, or garden in an area only 3 feet square.

13. Make prints of leaves to show the variety of life in the plant kingdom. Use plaster of paris casts to make the prints.

14. Make a museum by collecting examples of protists, plants, and animals. Preserve them in display jars. Classify specimens.

15. Prepare a miniature museum exhibit of a natural community. Use dry specimens, cutouts, and/or plastic or paper models to represent the members in the community.

16. Make large charts showing food chains.

17. Make large charts of the phylogenetic tree of plants and animals.

**REPORTS**

1. Report on economically important animals in South Florida.

2. Report on ecological problems in South Florida, such as the water hyacinth.

3. Report on wildlife conservation in South Florida.

4. Report on a carnivorous plant, such as the Venus Fly Trap.

5. Research the differences in food-getting adaptations between land and water animals.

6. Write about the relationship between certain cattle and the micro-organisms living in their digestive tract, aiding in the digestion of plant materials.

7. Make a report about a parasite that invades humans.

8. Prepare a report about organisms living on high mountain tops and how they are adapted to withstand conditions there.

9. Report about a bird or mammal that has become extinct within the past century.

10. Choose an animal and make a complete report about its life cycle and habitat.

11. Write a report on the importance of micro-organisms in the soil.

12. Prepare a report with sketches showing different kinds of food man gets from plants.

13. Prepare a report about antibiotics that have come from molds.

14. Read about the work of Linnaeus in the field of classification. Include some systems that were used before his.

15. Investigate how plant and animal populations have changed in your area over the years. What animals and plants living in the region are no longer there? Which new ones have taken their Place?

16. Read and tell about several examples of natural enemies of living things in the forest.

17. Find out how the introduction of rabbits into Australia developed into a serious problem.

18. Report about the difference between a normal cell and a cancerous one.

FIELD TRIPS

1. Crandon Park Zoo
2. Seaquarium
3. Any shore line or beach to study marine life.
4. Any canals or lakes to study fresh water life.
5. Fairchild Botanical Gardens
6. Museum of Science
7. Everglades National Park
8. A grove or nursery
9. A farm
10. A forest or woodland
11. A greenhouse
12. Parrot Jungle
13. A fish hatchery
14. Visit a beekeeper

DADE COUNTY 16mm FILMS

1. Adaptations in Plants
   AV#1-11107, 15 minutes, C.

2. Adaptations of Plants and Animals
   AV#1-111059, 13 minutes, C.

3. Algae
   AV#1-11117, 16 minutes, C.

4. Animal Predators and the Balance of Nature
   AV#1-05650, 11 minutes, C.

5. Animals with Backbones
   AV#1-02821, 11 minutes, C.

6. Animals without Backbones
   AV#1-02716, 11 minutes, C.

7. Arthropds: Insects and Their Relatives
   AV#1-02736, 11 minutes, C.

8. Balance in Nature
   AV#1-11059, 13 minutes, C.

9. Between the Tides
   AV#1-11071, 20 minutes, C.

10. The Bird Community
    AV#1-1-02904, 12 minutes, C

11. Birth of a Florida Key
    AV#1-12252, 18 minutes, C.

12. Cell Division
    AV#1-0236, 11 minutes, BW.

13. The Changing Forest
    AV#1-11496, 19 minutes, C.

14. Characteristics of Plants and Animals
    AV#1-02215, 10 minutes, C.

15. Food Getting Among Animals
    AV#1-11140, 13 minutes, C.

FILMS (CONT'D)

16. The Hot, Dry Desert
AV#1-02393, 16 minutes, C.

17. Introducing the Reptiles
AV#1-11183, 17 minutes, BW.

18. Lichens and Mosses
AV#1-11113, 22 minutes, C.

19. Life in a Drop of Water
AV#1-02719, 10 minutes, C.

20. Life in the Desert
AV#1-02393, 11 minutes, C.

21. Life in the Forest
AV#1-03755, 11 minutes, C.

22. Life in the Grasslands
AV#1-02217, 11 minutes, C.

23. Life in the Ocean
AV#1-11043, 18 minutes, C.

24. Life in the Woodlot
AV#1-02397, 17 minutes, C.

25. Life on a Dead Tree
AV#1-02387, 11 minutes, C.

26. Marine Animals of the Open Coast
AV#1-11075, 22 minutes, C.

27. Marvels in Miniature
AV#1-11143, 15 minutes, C.

28. Microscopic Wonders in Water
AV#1-02677, 10 minutes, C.

29. The Mollusks
AV#1-11149, 14 minutes, BW.

30. Osmosis
AV#1-11094 , 14 minutes, C

FILMS (CONT'D.)

31. Partnerships Among Plants and Animals
AV#1-02657, 11 minutes, C.

32. Sponges and Coelenterates
AV#1-02172, 11 minutes, BW.

33. World of Little Things
AV#1-11146, 15 minutes, C.

SUGGESTED DISCUSSION QUESTIONS

1. What changes can take place in any pond, lake, river, over the next few thousands of years if man does not change the succession?

2. How may a natural community become established on an island that has been newly formed?

3. If parameciums make one division every 12 minutes, how many offspring will one paramecium produce in 24 hours?

4. Spores of mold have been found alive at very high altitudes on land. Suggest an explanation for their living under these conditions.

5. What characteristics distinguish living things from non-living things?

6. Why is it sometimes hard to determine if some living things are plants or animals?

7. In what ways are all living things alike? Different?

8. What are some advantages of classifying living things?

9. Algae are used for food in some countries. How do you think algae may be used as a source of food on long space flights?

SUGGESTED DISCUSSION QUESTIONS (CONT'D.)

10. What are three factors that limit where animals may live?

11. How does an amphibian illustrate a step between water-living and land-living animals?

12. Explain the statement, "With each change in the succession of plants comes a change in the animal life."

13. What are the similarities and differences between a single animal cell and a single-celled organism?

14. Compare and contrast three types of muscle tissue with regard to their structure and function.

15. Describe at least one type of cell in each of the following tissues: epithelial, blood, nerve, connective.

16. What is the significance of the substances known as enzymes? as hormones?

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2. Brandwein, Paul F., et al., The World of Living Things, New York: Harcourt, Brace, and World, Inc., 1964.

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4. Mason, John M. and Peters, Ruth T. Life Science, A Modern Course, Princeton: A. VanNostrand Co., 1965.

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10. Thurber, Walter A. and Kilburn, Robert. Exploring Life Science, Boston: Allyn and Bacon, Inc. 1970.


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12. Orana, R. Junior High School Science Activities. West Nyack, New York: Parker Publishing Co., 1969.

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